We Claim

1. A male coupling portion of the type configured for use with a female coupling portion to form a fluid-flow coupling structure, each of the male and female coupling portions defining a respective fluid flow path and being removably engageable with one another to communicate the respective fluid flow paths, each coupling portion including a respective valve element having a respective closed first position closing the respective fluid flow path from ambient, said respective valve elements moving to respective open second positions when said coupling portions are engaged together to communicate said fluid flow paths with one another, said male coupling portion comprising:

a guide structure including support means for supportingly and releasably engaging onto the female coupling portion;

said guide structure including structure for guiding a male probe portion, in reciprocation between a first position disengaged from the female coupling portion and a second position in which said male probe portion is engageable into the female coupling portion when said coupling portions are engaged together;

a male probe portion reciprocable on said guide structure and carrying said respective valve element of said male coupling portion, and said guide structure and respective valve element including cooperating structure for moving said respective valve element to its open second position in response to reciprocation of said male probe portion to its said second position;

an actuator rotationally carried upon said guide structure, said actuator and said male probe portion defining cooperating structure for reciprocating said male probe portion between its said first position and its said second position in response to rotation of said actuator.

2. The male coupling portion of Claim 1 wherein said guide structure includes a pair of diametrically opposite axially extending and arcuate guide tangs.

3. The male coupling portion of Claim 2 wherein said pair of axially extending arcuate guide tangs cooperatively define a substantially circular passage slidably receiving said male probe portion.

4. The male coupling portion of Claim 2 wherein said pair of axially extending arcuate guide tangs each define a pair of circumferentially opposite and axially extending side edges, each side edge of said pair of arcuate guide tangs being in circumferential confrontation with a side edge of the other of said pair of arcuate guide tangs to define an axially extending slot.

5. The male coupling portion of Claim 4 further including said male probe portion carrying a nut member reciprocating with said male probe portion, said nut member including a protrusion extending radially into said axially extending slot and slidably engaging with said circumferentially confronting side edges of said guide tangs to prevent relative rotation of said nut member while allowing axial relative movement.

6. The male coupling portion of Claim 5 wherein said cooperating structure of said actuator and said male probe portion includes said protrusion carrying a section of interrupted male thread radially outwardly disposed on a radially outer surface of the protrusion, said interrupted thread threadably engaging a female thread defined on an inner surface of said actuator member.

7. The male coupling portion of Claim 6 wherein said nut member includes a pair of diametrically opposite protrusions, each of said pair of protrusions carrying a respective one of a pair of interrupted male thread sections, and said actuator member includes a double-start thread engaging each of said pair of interrupted thread sections.

8. The male coupling portion of Claim 4 wherein said guide portion and said actuator member further define cooperating structure for allowing relative rotation of said actuator member while preventing axial relative movement.

9. The male coupling portion of Claim 8 wherein said cooperating structure of said guide portion and said actuator includes said guide portion defining a radially and circumferentially extending groove, said actuator including a radially and circumferentially extending rib received rotationally into said groove and preventing axial relative movement of said actuator on said guide portion.

10. The male coupling portion of Claim 9 wherein said guide portion includes a reentrant collar portion cooperating with a remainder portion of said guide portion to define an axially extending groove, said collar portion defining said radially and circumferentially extending groove of said guide portion.

11. The male coupling portion of Claim 1 wherein said cooperating structure of said guide structure and respective valve element for moving said respective valve element to its open second position in response to reciprocation of said male probe portion to its said second position includes said respective valve element being of generally tubular configuration and being slidably received on said male probe portion, said valve element further defining a radially outwardly extending flange engaging said guide portion upon reciprocation of said male probe portion to its second position.

12. The male coupling portion of Claim 4 further including said male probe portion carrying a thrust collar member reciprocating with said male probe portion, said thrust collar member and said actuator member including cooperating structure for transferring axial force therebetween while allowing relative rotation so that said thrust collar moves axially in unison with said actuator member.

13. The male coupling portion of Claim 12 wherein said cooperating structure of said thrust collar member and of said actuator includes said thrust collar having a pair of radially outwardly extending protrusions, and said actuator including a pair of axially spaced apart radially extending flanges receiving said protrusions therebetween.

14. The male coupling portion of Claim 4 wherein said guide portion and said actuator member further define cooperating structure for allowing relative rotation of said actuator member while simultaneously causing axial relative movement.

15. The male coupling portion of Claim 14 wherein said cooperating structure of said guide portion and said actuator member includes said guide portion defining a male thread and said actuator including a female thread threadably engaging said male thread so that said actuator moves axially along said guide portion in response to relative rotation to transfer axial force to a non-rotational thrust collar.

16. The male coupling portion of Claim 15 wherein said actuator includes a tubular portion received into said axial passage of said guide portion, said tubular portion and thrust collar defining cooperating structure for allowing relative rotation of said actuator member while transferring axial force to said thrust collar.

17. The male coupling portion of Claim 1 wherein said respective valve member of said male coupling portion includes a sealing sleeve member which is slidably carried on said male probe portion, said male probe portion defining an axially extending part of said respective fluid flow path of said male coupling portion and also defining an aperture opening laterally outwardly thereon, said sealing sleeve member in said closed first position spanning and closing said aperture, said sealing sleeve member including a radially outwardly extending element engageable with said guide portion upon forward reciprocation of said male probe portion to stop further forward motion of said sealing sleeve member so that said male probe portion continues forward toward said female coupling portion to uncover said aperture.

18. A coupling structure with male and female coupling structure portions each defining a fluid flow path, and each removably engageable with the other to open fluid communication therebetween, and said coupling portions also being disengageable from one another to close communication between each fluid flow path and ambient, each one of the male and female portions of the having a respective movable valve member in a first position closing communication with ambient and in a second position opening communication between the fluid flow paths of the engaged coupling portions, the male coupling portion comprising:

a guide structure including support structure for releasably engaging onto the female coupling portion so that the fluid flow passages of each coupling portion are axially aligned, said guide structure including structure for guiding a male probe portion in reciprocation between a first position disengaged from the female coupling portion and in which the respective valve member is in its closed first position and a second position in which said male probe portion is engaged into the female coupling portion and both said respective valve members are moved to their opened second positions;

said male probe portion being reciprocable on said guide structure and carrying

said respective valve element of said male coupling portion, and said guide structure and respective valve element including cooperating structure for moving said respective valve element axially of said male probe portion to its open second position in response to reciprocation of said male probe portion to its said second position relative to said guide structure; and

an actuator rotationally carried upon said guide structure, said actuator and said male probe portion defining cooperating structure for reciprocating said male probe portion between its said first position and its said second position in response to rotation of said actuator relative to said guide structure.

19. A method of effecting fluid flow communication between a pair of flow paths, and of isolating the flow paths from ambient when not in communication with one another, said method comprising steps of:

providing a female coupling structure having an axially extending fluid flow path, and a plug member in a closed first position spanning and closing this flow path, providing for said plug member to move axially to an opened second position;

providing a male coupling structure having an axially extending fluid flow path, and engaging said male coupling onto said female coupling structure with said fluid flow paths in axial alignment;

providing said male coupling structure with a guide member engageable with said female coupling structure, and a male probe portion defining said fluid flow path of said male coupling structure and reciprocable relative to said guide member; forming a port opening laterally from said flow path on said male probe portion, and disposing a respective axially movable tubular valve member in a first position spanning and closing said port to close communication with ambient and in a second position opening communication between the fluid flow path of the engaged coupling structures;

providing an actuator rotationally carried upon said guide member, defining in cooperation between said actuator and said male probe portion a cooperating structure for reciprocating said male probe portion between its said first position and its said second position in response to rotation of said actuator relative to said guide member; and

engaging said male and said female coupling structures, and relatively rotating said actuator to effect axial relative movement of said male probe portion so that said fluid flow paths are communicated with one another.

20. A two-part fluid coupling structure having a female coupling part for fluid-flow communication with a vessel, and a male coupling part for fluid-flow communication with a conduit, said coupling parts being mutually engageable to effect fluid-flow communication between said vessel and said conduit, and being disengageable to both discontinue said fluid-flow communication and also to mutually close fluid-flow communication between ambient and each of said vessel and conduit; said two-part coupling structure comprising:

said female coupling part having:

a female cap member defining a through passage communicating between ambient and said vessel;

a disk-like plug member spanning and closing said through passage of said cap member,

said male coupling part having:

an elongate probe member defining a blind axial passage for fluid-flow communication with said conduit, a lateral aperture adjacent to a forward end of said probe member and opening outwardly from said axial passage on said probe member, and a head portion adjacent to a forward end of said probe member for engaging with said plug member;

a sleeve valve member carried slidably on said probe member between a first position across and closing said lateral aperture and a second position at least partially rearwardly of and opening of said lateral aperture, said sleeve valve member having a radially outwardly extending portion at a rear end thereof

a guide structure reciprocably carrying said probe member and said sleeve member, said guide structure including a forward flange portion having a central opening therein, and means for engaging supportingly upon said cap member with said central opening in alignment with said through bore of said cap member, means for defining a guide way for said probe and sleeve member to allow reciprocation thereof via said central opening into and from said through bore of said female coupling part, said guide structure defining an abutment surface engaged by said radially outwardly extending portion of said sleeve member to stop relative motion thereof upon a certain advancement of said male coupling part

probe member relative to said forward flange portion, said probe member of said male coupling part continuing in forward advancement relative to said forward flange portion to move relative to said sleeve valve member to said second position thereof with said lateral aperture at least partially uncovered; and

an actuator rotationally carried upon said guide member and defining cooperating structure with said male probe portion for reciprocating said male probe portion relative to said guide member between its said first position and its said second position in response to rotation of said actuator relative to said guide member.

21. A male coupling assembly for use with a cooperatively configured female coupling assembly to form a fluid flow connection therebetween when the coupling assemblies are engaged together, said male coupling assembly comprising:

a guide structure having at a forward end thereof means for mounting to the female coupling assembly in axial alignment, said guide structure further defining a guide way leading toward and aligning with the female coupling assembly,

an elongate male probe member reciprocably received in said guide way in alignment with the female coupling assembly, said male probe member defining a blind axially extending passage leading to a lateral port opening outwardly on said male probe member near a forward end of said male probe member;

a sleeve valve member reciprocably carried upon said male probe member, said sleeve valve member being reciprocable between a first position spanning and closing said lateral port and a second position spaced from said forward end of said male probe member to open said lateral port;

actuator structure for reciprocating said male probe member between a first position within said guide structure and a second position in which at least a portion of the male probe member extends forwardly of said guide structure and is there engageable with a female coupling assembly;

said sleeve valve member and said guide structure having cooperating structure for stopping forward movement of said sleeve valve member with said male probe member upon reciprocation of said male probe member toward its second position so that said male probe member continues toward said second position thereof and said sleeve valve member is moved relative to said male probe member to the second position of said sleeve valve member;

said actuator structure including a sleeve-like hand nut rotationally carried upon said guide structure.

22. A connector structure with male and female connector parts each defining an axially extending fluid flow path, and each removably engageable with the other to open fluid communication therebetween, and said connector parts also being disengageable from one another to close communication between each fluid flow path and ambient, each one of the male

and female parts having a respective movable valve member in a first position closing communication with ambient and in a second position opening communication between the fluid flow paths of the engaged connector parts, the male connector part comprising:

a guide structure including support structure for releasably engaging onto the female connector portion in response to lateral relative movement of the connector parts so that the axially extending fluid flow passages of each connector portion are axially aligned, said guide structure including structure for guiding a male probe portion in reciprocation between a first position disengaged from the female connector portion and in which the respective valve member is in its closed first position and a second position in which said male probe portion is engaged into the female connector portion and both said respective valve members are moved to their opened second positions;

said male probe portion being reciprocable on said guide structure and carrying said respective valve element of said male connector part, said respective valve element of said male connector part having a surface axially engageable with said female connector part to stop forward reciprocation of said valve element in unison with said male probe portion; and

a manually rotational actuator carried upon said guide structure, said actuator and said male probe portion defining cooperating structure for reciprocating said male probe portion between its said first position and its said second position in response to rotation of said actuator relative to said guide structure.